Early Journal Content on JSTOR, Free to Anyone in the World

This article is one of nearly 500,000 scholarly works digitized and made freely available to everyone in the world by JSTOR.

Known as the Early Journal Content, this set of works include research articles, news, letters, and other writings published in more than 200 of the oldest leading academic journals. The works date from the mid-seventeenth to the early twentieth centuries.

We encourage people to read and share the Early Journal Content openly and to tell others that this resource exists. People may post this content online or redistribute in any way for non-commercial purposes.

Read more about Early Journal Content at http://about.jstor.org/participate-jstor/individuals/early-journal-content.

JSTOR is a digital library of academic journals, books, and primary source objects. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations. JSTOR is part of ITHAKA, a not-for-profit organization that also includes Ithaka S+R and Portico. For more information about JSTOR, please contact support@jstor.org.

amounts to placing each line in the equation equal to zero. Hence we have

$$v + \Delta v = r_0 c_0 \sum_{i=0}^{i=\infty} Z_i$$

$$= \tfrac{3}{2} h \frac{\rho}{\rho_m} \left\{ \sum_{i=0}^{i=\infty} \frac{Y_i}{1 - \frac{3}{2i+1}\frac{\rho_w}{\rho_m}} - \frac{U_0}{1 - 3\frac{\rho_w}{\rho_m}} \right\}. \qquad (56)$$

This equation expresses the total effect of the disturbing mass in altering the sea-level, v being the effect which would result if the ocean were an infinitely rare fluid, and Δv being the increase over v which would result under the assumed conditions. Obviously v and Δv may be expressed separately. Thus: —

$$\Delta v = \tfrac{3}{2} h \frac{\rho}{\rho_m} \left\{ \sum_{i=0}^{i=\infty} \frac{3Y_i}{(2i+1)\frac{\rho_m}{\rho_w} - 3} - \frac{3U_0}{\frac{\rho_m}{\rho_w} - 3} \right\}. \qquad (57)$$

[TO BE CONTINUED.]

* * *

NOTES.

8

ON THE LAST CLAUSE OF ART. 140 OF GAUSS'S THEORIA MOTUS.

The clause mentioned is as follows: —

"Calculo examinando sequentes quoque formulae inservire possunt, quarum tamen derivationem non ita difficilem brevitatis caussa supprimimus: —

$$0 = \frac{a \sin(l'' - l')}{R} - \frac{b \sin(l'' - l)}{R'} \cdot \frac{\sin(\delta' - \sigma)}{\sin \delta'} + \frac{\sin(l' - l)}{R''},$$

$$b = \frac{R' \sin \delta'}{R'' \sin \delta''} \cdot \frac{U \cos \beta \cos \beta''}{\sin(AD' - \delta) \sin \varepsilon'};$$

ubi U exprimit quotientem $\frac{S}{\sin(\delta' - \sigma)} = \frac{T \sin(t + \gamma')}{\cos(\delta' - \sigma)}$ (art. 138. aequ. 10)."

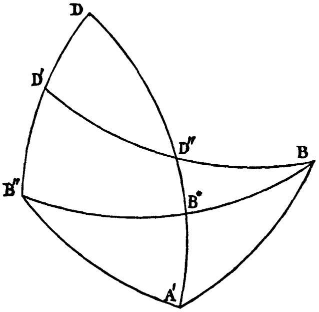
Notwithstanding the words "non ita difficilem," the derivation of these equations is not generally readily seen by the student reading the *Theoria Motus* for the first time.

The first equation is obtained from equation III of the same article, by substituting the heliocentric positions of the earth for those of the celestial body whose orbit is to be determined; i. e. by putting $n = R'R'' \sin(l'' - l')$, $n' = RR'' \sin(l'' - l)$, $n'' = RR' \sin(l' - l)$, and $z = \delta'$.

The second equation is derived as follows: —

Put $L = \dfrac{\sin(A''D - \delta'')}{\sin(A'D - \delta' + \sigma)}$ (see equation 11) $= \dfrac{\sin B''D}{\sin B^*D}$. The triangle $B^*B''D$ gives

$$L = \frac{\sin B''B^*D}{\sin B^*B''D}.$$



From the triangles $A'B''B^*$, $A'BB''$, and $BB''D'$ we have

$$\sin B''B^*D = \sin B''B^*A' = \frac{\sin A'B''}{\sin A'B^*} \sin B^*B''A',$$

$$\sin B^*B''A' = \frac{\sin A'B}{\sin BB''} \sin BA'B'',$$

$$\sin B^*B''D = \frac{\sin BD'}{\sin BB''} \sin BD'B'';$$

whence
$$L = \frac{\sin A'B''}{\sin A'B^*} \cdot \frac{\sin A'B}{\sin BD'} \cdot \frac{\sin BA'B''}{\sin BD'B''}.$$

A' is the heliocentric place of the earth (longitude l', latitude 0) at the time of the second observation; B and B'' are the geocentric positions of the celestial body at the times of the first and third observations (longitudes α, α'', latitudes β, β'').

Putting $BA'B'' = BA'B^* + B^*A'B''$,
and remembering that

$$\sin\beta = \sin A'B \cos BA'B^*,$$
$$\sin\beta'' = \sin A'B'' \cos B^*A'B'',$$
$$\cos\beta \sin(l' - \alpha) = \sin A'B \sin BA'B^*,$$
$$\cos\beta'' \sin(\alpha'' - l') = \sin A'B'' \sin B^*A'B'';$$

we have, after reduction,

$$\begin{aligned}\sin A'B'' \sin A'B \sin BA'B'' &= \sin\beta \cos\beta'' \sin(\alpha'' - l') - \sin\beta'' \cos\beta \sin(\alpha - l') \\ &= \dot{S} \cos\beta \cos\beta'' \text{ (see art. 138. eq. 7)} \\ &= U \sin(\delta' - \sigma) \cos\beta \cos\beta''.\end{aligned}$$

We have also, by definition, $A'B^* = \sin(\delta' - \sigma)$, $BD' = AD' - \delta$, and $BD'B'' = \varepsilon'$;

$$\therefore \quad L = \frac{U \cos\beta \cos\beta''}{\sin(AD' - \delta) \sin\varepsilon'}, \quad Q.\ E.\ D.$$

[*Ormond Stone.*]